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Description

Electronic component and coating medium

The invention relates to an electronic component, particularly to an electro-optical component, with a plastic housing that contains at least one metallic contact surface. It further relates to a coating medium for such a component, and to a method used to produce such a component.

When soldering or unsoldering electronic components, solder splash often accumulates on surfaces not intended for soldering. This presents a particular problem with relatively small SMD components. With electro-optical components, particularly with receiving or transmitting devices such as light-emitting diodes (LED's), for example, solder splash on the housing may affect the function of a light-emitting or receiving semi-conductor component, and may suppress the light or signal output. Unintentional solder bridges may also easily lead to short circuits between closely-positioned connection contacts or soldered surfaces.

Solder splash on components occurs especially during automated configuration of circuit boards with SMD components using a so-called "pick-and-place" process. Coating with paints containing solvents or other coatings has not produced satisfactory results in this regard.

The task of the invention is to produce an electronic component for which the adhesion of solder splash or solder itself to surfaces not intended for soldering is prevented to the greatest extent possible. In particular, such a surface-mountable component is to be developed that may be packed in belts and subsequently used by conventional pick-and-place processes of SMT[1] technology.

Further, a method for the production of such components is to be described.

The solution of this task is achieved by a component possessing the characteristics of Patent Claim 1, by a method possessing the characteristics of Patent Claim 8, and with a coating medium possessing the characteristics of Patent Claim 15.

Advantageous configurations and embodiments are the subjects of Patent Claims 2 through 7, 9 through 14, or 16 through 25.

According to the invention, the plastic housing (except for the metallic soldering contacts) is covered with a coating that prevents solder adherence (hereafter, anti-solder coating).

In order to prevent the occurrence of solder splash in the form of small solder accumulations on electronic component surfaces not intended for soldering, particularly during immersion in a solder bath or during solder flood processes, the invention suggests an anti-solder coating on the electrical component surfaces not intended for soldering that prevents solder adherence.

In a particularly advantageous embodiment of the invention, the anti-solder coating essentially consists of siloxane.

Accordingly, an anti-solder coating comprised of siloxane based on a polyether- modified dimethyl-polysiloxane is especially preferred.

Accordingly, the anti-solder coating is preferably applied using a 0.01 – 5% hydrous solution, especially using a 0.01 – 2.5% hydrous solution, that preferably contains no other solvent compounds. Using a 0.01 – 2.5% hydrous solution, non-adhesion to the coating is advantageously ensured, which is of decisive importance during pick-and-place processes used in surface-mounting techniques.

In a particularly preferred embodiment of the invention, application of the anti-solder coating is performed at room temperature.

The thickness of the anti-solder coating, particularly for electro-optical transmitting and/or receiving components, is most preferably less than 3 μm, and renders as a result virtually no influence on the optical characteristics of the coated components.

Based on the invention, a highly-effective homogenous anti-solder coating is created that advantageously involves no viscous intermediary solution, thanks to its special chemical structure and by the use of hydrous systems. A special advantage to this is that no environmentally damaging solutions are used. Also, no residual droplets from highly-volatile

[1] Translator's Note: SMT is probably a typo for SMD.

intermediary solutions are produced that may make proper soldering of the electrical component difficult or impossible. The thermal post-processing step formerly used is no longer required, thus allowing an increase in production output and a reduction in production time. There are no functional effects on the coated components. The coatings produced are further distinguished by long shelf life and homogeneity, thus increasing component quality and reducing the number of rejects.

Further, the invention relates to a coating medium for the reduction of solder splash on surfaces of a multi-surface electrical component not intended for soldering but containing at least one surface for soldering, whereby the coating is applied to the surfaces not intended for soldering, and whereby the coating is a siloxane.

Accordingly, based on a further embodiment of the invention, the coating medium consists of a polyether-modified dimethyl-polysiloxane.

The coating medium is advantageously dissolved in a 0.01 – 5% hydrous solution (preferably in a 0.01 – 2.5% hydrous solution) for application onto a surface provided for this purpose without the use of any other additional solvent compounds. Thus, after application of the coating medium and evaporation of the water from the hydrous solution, an even disposition of the coating medium is ensured without any other hard-to-evaporate solvent residue being left behind. An advantage of this is that use of a hydrous solution does not require the use of environmentally damaging solvents. The coating medium shows no typical coloration or residue on the component surface resulting from thermal decomposition reactions that formerly resulted from the necessary heat treatment that caused the solution to evaporate.

The hydrous solution is preferably applied to the entire housing of the component using stamping (e.g., using a tampon, roller, or sponge), immersion (using a dipping bath), spraying, or application with a micro-dosing process using fine needles. A potentially brief exposure time of between preferably about 1 second and 30 seconds using the hydrous solution based on the invention advantageously prevents damaging intrusion of the solution into the plastic housing to the greatest extent possible. Thus, mechanical damage within the plastic housing during the soldering process and during operation, such as delamination, for example, is reduced.

The film is advantageously dried in a stream of air that need not be at an increased temperature.

Use of a hydrous solution without additional solvents greatly prevents emissions hazardous to health. The coating material further shows a low potential for hazard to man and environment, particularly a low vapor pressure. Used coating solutions may be subsequently disposed of without difficulty, and coated components may be used in particularly critical application fields such as automotive interiors, consumer electronics, and medical care because of the low vapor pressure.

Buffered coating solutions with a pH value between about 5.0 and 7.0 may advantageously be stored for up to three months for subsequent use.

The anti-solder coating is advantageously very stable with respect to light, and this factor may be further increased by the addition of light shielding media and UV absorbers (e.g., benzophenone, benzoriazole, steric-retarded amines with pH advantageously between 6.0 and 7.5), whereby the radiation and weathering stability of the plastic housing are increased. The coating is also advantageously suited for electro-optical components with intensive and/or high-energy radiation output, such as LED's and high-output LED's that emit blue light and UV radiation.

The coating solutions are preferably applied to thermoplastic housings made of LCP, PBT, PET, PC, PA, and/or especially preferred polyphthalamide with or without filler material (e.g., titanium oxide, silicon oxide, aluminum oxide, etc.) and/or epoxy resin-, silicon-, or acrylate cast materials (advantageously epoxy anhydride cast materials). The epoxy resin, silicon- or acrylate cast materials may contain diffuser materials such as calcium fluoride, barium sulfate, silicon oxide, aluminum oxide, glass globes, etc., or luminescence-converting pigments.

Further advantages, special properties, and useful embodiments of the invention may be taken from the sub-claims and from the embodiment example explained by the illustrations below.

These illustrations include the following:

Figure 1 shows a schematic cross-section view of an embodiment example of a soldered electrical component with an anti-solder coating according to the invention; and

Figure 2 shows a schematic cross-section view of a soldered, conventional electrical component with solder splash.

Figure 1 shows a surface-mountable radiation-emitting and/or radiation-sensitive electro-optical component 1 in soldered condition. The metallic soldering areas 4 of component 1 are soldered to the conductors 8 printed on the circuit board 7 using solder 3. The other areas 5 of the surface 2 of a plastic housing 14 of the component 1 that are not intended for soldering are covered by an anti-solder coating 6. Moistening of the surfaces 5 of the plastic housing 14 with solder is almost completely prevented by the use of polyether-modified dimethyl polysiloxane as the main ingredient of the anti-solder coating 6 according to the invention.

Figure 2 shows schematically such undesired moistening or adherence 10, 11, 12, and 13 by solder 3 to unintended surfaces 5 of a housing 14 of a conventional surface-mountable radiation-emitting and/or radiation-sensitive electro-optical component 1 without anti-solder coating. The component 1 is again shown in soldered condition. The metallic soldering areas 4 of component 1 are again soldered to the conductors 8 printed on the circuit board 7 using solder 3. Now scattered adhesion of solder splash 10 (solder, flux, etc.) occurs from raw or lightly moistenable points, such as for example the lens of a LED, including adhesion of solder splash 11 in angles or corners of the surface 2 of the component 1, as well as overhang of solder 12 that arises as a result of partial moistening of the areas 5 not intended for soldering, and also short-circuiting solder bridges 13 that arise from the converging solder 3 on the surface 2 between individual contact or solder surfaces 4.

A hydrous solution of the anti-solder coating material is preferably applied using stamping (e.g., using a tampon, roller, or sponge), immersion (using a dipping bath), spraying, or application using a micro-dosing process with fine needles to the entire surface-mountable radiation-emitting and/or radiation-sensitive electro-optical component. A brief potential exposure period to the

hydrous solution of between 1 and 30 seconds based on the invention advantageously almost completely prevents a damaging intrusion of the solution into the plastic housing. Thus, mechanical damage within the plastic housing during the soldering process and during operation (such as delamination, for example) may be reduced.

The film is advantageously dried in a stream of air that need not operate at an increased temperature.

According to the invention, the hydrous solution of the polyether-modified dimethyl-polysiloxane consists of 0.1 – 5% polyether-modified dimethyl-polysiloxane, such as for example BYK348 made by Byk-Chemie GmbH, and deionized water. This achieves an optimal dry lead frame and a homogenously-coated housing without the use of special masks or other auxiliary means.

Avoidance of special heat treatment for drying purposes or for the purpose of homogenization of the coating is especially advantageous. In this manner, higher volume output and more rapid production are achieved.

The anti-solder coating preferably contains a light shielding medium and an UV absorber (e.g., benzophenone, benzoriazole, steric-retarded amines with pH preferably between 6.0 and 7.5), whereby the radiation and weathering stability of the plastic housing are increased.